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we expect "strict accuracy of language," nor the "critical judgment of a Gibbon or Grote" (p. 372).

Professor Sayce shares the judgment of the critics on the author of Chronicles. Like the "commentators down to the time when the Assyrian inscriptions were discovered" he drew "erroneous inferences" from what he "had read in the book of Kings," thus making Pul and Tiglath-Pileser two distinct persons, when Pul was only another name for the Assyrian king "The Chronicler displays that partiality "for large numbers which is still characteristic of the Oriental." Here we find the beginnings of the Jewish Haggadah. The Book of Jonah "belongs to a later period than the age of the prophet Jonah, the son of Amittai" (p. 487). Esther belongs "to the Jewish Haggadah" (moral romances). With reference to the Book of Daniel contemporaneous evidence shows that Belshazzar "never became king"; neither was he the son of Nebuchadnezzar, "as we are repeatedly told in the fifth chapter of Daniel." He was the son of Nabonidus, who was a usurper and without connexion with the family of Nebuchadnezzar. "Darius, the Mede," is a reflexion into the past of Darius Hystaspes. Many points are urged in support of a *late* date. The author was unacquainted with the language of Babylonia and lived "at a period later than Alexander the Great."

Such is the verdict, and its almost complete accord with "critical" results makes it all the more to be deplored that Professor Sayce "has treated," to use his own phrase, the "critics" with such "scant courtesy." It is to be regretted that he did not discriminate between the "critics" and tell his readers to whose views the conclusions he draws from the monumental records are opposed. It is most of all to be regretted that the impression should be made upon those who are not acquainted with the history of criticism, and with the conclusions accepted by the more moderate critics, that the traditional views have been confirmed and the "critics" buried with the same spade. Professor Sayce does not say so, but unfortunately the inference is drawn, hence a reputed scholar, who has read the "Verdict," not long since proclaimed to his audience that the "Scriptures are accurate, even in the details." This, too, in a University town!

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THE DAWN OF ASTRONOMY. A Study of the Temple-Worship and Mythology of the Ancient Egyptians. By *J. Norman Lockyer, F. R. S.*, etc., etc. New York and London: Macmillan & Co. 1894. Pages 432.

Most of the recent progress in astronomy is due to the aid which it has received from other sciences; and this debt, which Professor Lockyer acknowledges in his preface, he has undertaken in the present work to in part repay to the benefit of the science of religions.

His excursion into this unaccustomed field was first suggested by the peculiar placing of the Parthenon and the many changes of direction in the successive re-

buildings of the temple at Eleusis, as revealed by the French excavations. These circumstances attracted his attention while making a casual examination of the ruins in the company of a friend during a holiday tour of the Levant.

Recalling the fact that in England the eastern windows of properly constructed churches are supposed to face the place of sun-rise on the feast-day of the saint to which they are dedicated, he made a careful note of the orientation of the foundations in question. After his return he endeavored to ascertain whether the subject had ever been worked up, but could then learn of nothing except in regard to the Christian churches of England and Germany.

On account of the presumable dependence of the Eleusinian temple-building upon ideas of Egyptian origin, he examined the data regarding the orientation of Egyptian temples collected by the French in 1789 and the Germans in 1844. He soon became convinced that astronomical considerations had determined the manner of their construction, and in a course of lectures delivered at the School of Mines in 1890 (published in *Nature*, April–July, 1891) he pointed out the probable utility of a study of the exact bearings of the religious edifices of Egypt in the light of astronomical facts as a means of ascertaining the exact dates of their foundation and of obtaining a fuller knowledge of the origin and significance of the Egyptian mythology.

Shortly afterwards he proceeded to Egypt to make some inquiries and investigations on the spot, for the purpose of verifying and correcting the published orientations, and gathering connected data important to a determination of their true astronomical and religious significance. The work before us is chiefly based upon the notes made during this trip, from which he returned in March, 1891, in connexion with the great official reports of 1798 and 1844 (Napoleon and Lepsius), and a series of papers on the orientation of ancient temples previously published by Professor Nissen, of Germany (in the *Rheinisches Museum für Philologie*, 1885), which Professor Lockyer did not see until after his investigations in Egypt had been made.

The author has availed himself freely of the personal assistance of Professors Maspero, Krall, and Müller in the general work, and of Sayce and Jansen in his comparative studies in Babylonian astro-mythology. He very modestly disclaims any pretensions to being considered an Egyptologist, and publishes this book as a suggestion and guide to future work rather than as a summary of definite results. Final conclusions, he says, can only be reached after a great deal of very patient and laborious special work has been done, both on the astronomical and archæological sides, directed towards the collection of a far more full, exact, and reliable series of data than is now in existence.

The most important part of this work is a re-survey of the temple sites, with modern instruments and methods. Then the astronomers must prepare tables of the rising and setting conditions of the stars for a period extending to at least seven thousand years before Christ. The table published by the German Astronomical

Society, which is the best thus far available, goes back only to 2000 B. C., and does not include the southern stars. In the meantime, the Egyptologists must arrange tables of synonyms, showing the local names of mythological personages, and the animals, or tribal totems, with which they are severally identified in different parts of the country. "After this work has been done," he says, "it will be possible to begin to answer some of the questions which I have only ventured to raise."

Professor Lockyer enters upon his subject by a few general remarks regarding the astronomical and astro-mythological data yielded by the surviving records of ancient civilisations.

The first civilisation so far traced was in the Nile valley and adjacent countries of Western Asia. In Egypt we can go back six or seven thousand years, in Babylonia over five thousand (but with evidence that eclipses and other astronomical phenomena had been observed there for some thousands of years before that time), and in China and India, where monumental remains are lacking, and we have to depend upon traditional evidence, at least four thousand.

An examination of the texts, on stone, or brick, or papyrus, or paper, which record the thought of this remote antiquity, shows that the observation of the heavenly bodies has passed through three distinct stages, the first characterised by a feeling of wonder and worship, the second by a desire for immediate practical advantage and for secret information as to the present or future affairs of men (astrology), and the third by a love of knowledge for its own sake.

The last phase, which seems to have been reached in Egypt and Chaldea before 300 B. C., now prevails in civilised countries; and this scientific interest is practically the only one which astronomy has for us moderns. But for thousands of years before the scientific profession had arisen the phenomena of the heavens were carefully studied and recorded in the religious, agricultural, and astrological interests. So closely was this study bound up with religion in the earliest times that in ancient Babylon the sign for "god" was a star, and a group of three stars is one of the Egyptian hieroglyphs for the plural "gods." Oddly enough the worship stage of astronomical research is entirely missing from the annals of the ancient Chinese, the utilitarian motive having apparently dominated there from the first. In India, of whose early mythology we have a very full record in the Vedas, the sun and the dawn, the over-arching heavens, the earth, and the fire, and the waters, and the storm-clouds, were the deities first adored.

In Egypt we find a similar state of affairs. The sun and the dawn were the chief objects of worship from the very earliest times, and everything connected with the sunrise and the sunset was worshipped. Under countless names the same diurnal or perennial phenomenon was recognised and venerated. The rising or Child Sun was the hawk-headed Harpocrates, Hor, Horus, or Chepera; the sun of noon was Râ, the evening sun Tum or Atmu, and the sun already set Osiris. Amen-Râ probably signified the sun at the summer solstice, and Sebak-Râ (with the crocodile head) and Chnemu-Râ (with the ram's head) possibly had reference to other spe-

cial seasons of the year, while Min-Râ signified the everlasting and vivifying solar energy.

Antithetical to the sun was a god of darkness variously known as Sit, Set, Sut, Anubis, Typhon, and Bes, and by countless other appellations. Anubis is represented as a jackal, and the goddess Taur-t, the feminine counterpart of Typhon, is represented as a hippopotamus.

Besides the sun-gods and the gods of darkness there are two moon gods, Thoth and Chons, and a goddess of the stars or of the starry heavens called Sesheta.

A large number of divinities are associated with the phenomena of dawn and twilight. Isis represents both dawn and twilight, but especially the sunrise; Nephthys represents both, but especially the sunset. Shu is also the dawn, or the sunlight in general or the air, and Tefnut represents the colored rays at dawn. Shu and Tefnut are called the Eyes of Horus. Neshem is the green-tinted dawn, and Sechet is the fiery dawn.

The sky is Nu or Nu-t, and with it Hathor, the female power of Nature, is sometimes identified. Seb is the earth. Chnemu, the Moulder, is connected with Râ; and Ptah, the Opener, often appears as a form of Osiris.

The under-world, Amenti, the abode of the dead, was the place below the Western horizon where the stars which died on the horizon lived until their rebirth in the East on the morrow.

Much attention was paid to the fixed stars from the earliest times of which we have any knowledge. One of the chief duties of the sacrificial priests was to watch for the stars which heralded the dawn, and thus gave warning when to prepare for the sacrifices which were offered at daybreak. These morning-watchers soon acquired a knowledge of star-places and compiled lists of decans, or belts of stars the rising of which followed each other by ten days or so. "These are the exact equivalents of the moon stations which the Indo-Europeans and other peoples invented for the same purpose." Moreover, the daily risings of the chief stars were observed very carefully throughout the year.

These facts have long been known; but the important circumstance that the placing of the temples was determined by astronomical considerations has hitherto escaped attention. It has been customary to accept the statement of Vitruvius that the temples were built simply to face the Nile. Archæologists who had personally investigated the matter, however, found that their arrangement was principally characterised by the want of it, as they faced in all directions, apparently without any system or order whatever. Their natural conclusion was that the Egyptians had a sort of symmetrophobia, mitigated perhaps by a general desire that the temple should face the Nile. But when the orientations are carefully studied (due allowance being made for the magnetic variation) with reference to the dates of their erection so far as known, it is found that their axes were always directed towards some celestial body at its rising or setting on some day of critical interest either from the astronomical, agricultural, or religious point of view.

Every temple was so built that its central axis was open and commanded a view of the horizon. Usually it had a large number of halls, corridors, porticos, and approaches, but the doors were so cut and the spaces so arranged that there should be no obstruction along that medial line. The opening on the outside was quite broad, and each succeeding partition narrowed it somewhat until in the Holy of Holies only a very narrow entrance remained, but always exactly opposite the centre of the outer opening often more than five hundred yards away. This arrangement was determined by the same principle which governs the construction of the telescope. "They wanted to keep the light pure and to lead it into their sanctuary "as we lead it to the eye-piece. To keep the light that passes into the eye-piece of "the modern telescope pure, we have between the object-glass and the eye-piece a "series of what are called diaphragms; that is, a series of rings right along the "tube, the inner diameter of the rings being greatest close to the object-glass and "smallest close to the eye-piece; these diaphragms must so be made that all the "light from the object-glass shall fall upon the eye-piece, without loss or reflexion "by the tube.

"These apertures in the pylons and separating walls of the Egyptian temples "exactly represent the diaphragms in the modern telescope" (p. 108).

Through this horizontal telescope formed by the temple axis the first rays of the sun or star at its rising, or the last rays at its setting, would flash for a few minutes into the darkened sanctuary at a certain time in the year, thus furnishing data for exact astronomical calculations, and at the same time forming a most impressive culmination to the festal rites with which the occasion was celebrated.

A classification of the temples according to their orientations separates them into several groups according as they are oriented (1) towards the rising or setting of the sun at the summer or winter solstice, (2) towards the rising or setting of the sun at the equinoxes; (3) towards the rising or setting of the stars in the northern heavens; (4) towards the rising or setting of stars in the southern heavens.

The chief stars thus far ascertained to have special temples are the southern stars Sirius, Phact (α Columbae), α Centauri, and Canopus (α Argus); and the northern stars Dubhe (α Ursae Majoris), γ Draconis, Capella, and Spica. Seven temples built between the years 3150 and 700 B. C. have been identified as directed towards the rising of Sirius at the summer solstice. Phact, which preceded Sirius as a warning star for sunrise at the summer solstice, has twelve temples, erected between 3700 and 900 B. C. Nine temples, built between 3700 and 2450 B. C., are connected with α Centauri, which then heralded the sunrise at the autumnal equinox. Dubhe has three known temples (5200-4200 B. C.), and γ Draconis which, after Dubhe became circumpolar and ceased to rise and set, succeeded it as the representative of the northern stars, and which announced the sun at the autumnal equinox a thousand years before α Centauri, seven temples (4600 to 1200 B. C.).

To Canopus, which at first set just after the sun at the autumnal equinox, are credited eight temples (6400-300 B. C.). The temples directed toward Capella and

Spica were not associated with equinoxes or solstices, but nevertheless, as in the other cases, they admitted the light of those stars on days when they rose or set with the sun. Capella had five temples, built between 5350 and 1750, and Spica two temples, built about 3200 and 1900 B. C. respectively. Antares (α Scorpii) rose heliacally at the autumnal equinox, and Aldebaran and the Pleiades at the vernal equinox, when some of the equinoctial temples were built, and were doubtless observed and venerated in them. Besides the stars thus far named, Arcturus, α Leonis, α Phenicis, β Muscae, α Trianguli, α Pavonis, Altair, and β Argus are suggested as having probably received attention as the patronal stars of temples, on account of the positions which they occupied in relation to the solstitial or equinoctial sun during some part of the temple-building period; and Vega is supposed to have preceded Dubhe as the representative of the northern stars.

Temples could only be oriented towards the stars which rise and set; but the circumpolar stars which never disappeared were distinguished sharply from the rest, and received special attention at a very early date, being regarded as the special representatives of the powers of darkness, and consecrated to Set (= Anubis, Typhon, Tebha), who was at first among the greatest of the gods. At Thebes, where the area of the stars always visible was only about one-fourth of what it is with us, the chief circumpolar stars were those included in the constellations of the Thigh (Great Bear), the Hippopotamus (Draco), and the Jackal (the Little Bear); and these were called respectively the Thigh of Set, the Wife of Set (Taur-t), and the Jackal of Set. As the hippopotamus was not indigenous to Upper Egypt it came in the later astromythology to be replaced in great measure by the crocodile. Set or Anubis was sometimes identified with the constellation of Ursa Minor, and was accordingly represented with a jackal's head. More frequently, however, Set is a generic name for all the northern constellations and for the darkness over which they reign.

The Egyptians were great generalisers, and many of the names which are particularly applied to the sun in some specified part of its daily round are so extended as to refer to stars in an analogous position. Thus, the word Horus really signifies the sun or any heavenly body rising. The planet Mars becomes Hor- χ uti, the Laughing or Red Horus; Orion rising becomes Sah-Horus, and the most northerly of the stars that rise become Set-Horus. The myth regarding the combat of Horus with Typhon to revenge the death of his father, Osiris, signifies that the rising sun destroys the circumpolar stars, who at twilight had conquered the sun of yesterday. This myth was at first depicted as Horus slaying the hippopotamus or the crocodile (Draco), but in later times when Draco ceased to be circumpolar the Hippopotamus was replaced by the Thigh of Set (Ursa Major), which in 2000 B. C. occupied exactly the same position as Draco had three thousand years before.

Osiris and Isis were, like Horus, generic names for a whole group of analogous celestial phenomena. Osiris stood for any celestial body becoming invisible; not only the setting sun, but the waning moon, or planets and fixed stars at their setting or when paling at dawn. The planet Venus often receives the appellation;

Orion paling before the sun is called Sah-Osiris, and the forms Khons-Osiris, Ptah-Osiris, and Min-Osiris appear to be the stars Canopus, Capella, and Spica at their setting. The mummy form habitually marks a setting star, and the horns and disk a rising one. The one is Osiris and the other Isis.

Isis stands for "anything luminous to the eastward heralding sunrise." Sometimes it is the dawn, sometimes the moon, sometimes γ Draconis, sometimes Antares, sometimes α Centauri, sometimes α Columbae, and sometimes Sirius. As γ Draconis it is synonymous with Hathor (hawk, hippopotamus), Mut (vulture), Sechet or Bast (lion or cat), Menkh, Tafnet, Apet, and Nebun. As Antares it is Serk-t; as α Columbae Techi and Amen-t; as Sirius Hathor (cow) and Râ-t. Anuqua, Hak-t, and Maloul are also forms of Isis, but their astronomical relation has not yet been determined.

Isis in one or another of her forms (Hathor, Remen-t, Serk-t, Râ-t, Amen-t) is often represented as nursing Horus; "the original symbolism is that Isis or Hathor "is the star rising in the dawn, watching over the sun or taking him from his cradle; and the young Horus, the Rising Sun, is, of course, the son of Isis."

Professor Lockyer supports the foregoing identifications by evidence from the inscriptions and other subsidiary sources, but more particularly upon the comparative study of the orientation of the temples in successive periods.

This brings us to the interesting and important conclusions regarding the general religious history of Egypt towards which the data collected by Professor Lockyer point. The monuments seem to represent four schools of religious thought and astronomical interest, devoted respectively to the solstitial sun, the equinoctial sun, the northern stars, and the southern stars. The Northern School is related to the solstitial, and the Southern to the equinoctial; and the evidence, taken altogether, indicates that these two main divisions represent two races which maintained a struggle for the supremacy for more than three thousand years. The outline of the history is reconstructed by Professor Lockyer's hypothesis as follows.

"6400 B. C. A swarm of worshippers of the moon and the equinoctial sun come down the Nile and possess themselves of the country, which they find occupied by a population worshipping Râ and Atmu. The invaders build temples at Amada, Senneh, Philae, Edfu and elsewhere to Osiris their moon-god, directed towards the autumnal equinox, which marks the beginning of their lunar year. They inaugurate what the Egyptian annals call the divine dynasty of Osiris.

5400 B. C. Invaders from the north-east bring the worship of Anu and the northern stars. One swarm comes by the Red Sea, and founds temples at Redisieh and Denderah; another may have come over the isthmus and founded Annu. Either they came from northern Babylonia or else other swarms of the same race invaded that country at the same time. The divine dynasty of Set begins.

5000 B. C. Horus and his Blacksmiths (*Hor Sheshu*) come down the

river to revenge his father Osiris by killing the murderer Set. In other words, they have come to assist the former southern invaders who worship Osiris against their conquerors from the north-east who have replaced him by Set. The southern people have now become sun-worshippers, and Osiris means the sun as well as the moon.

The people from the north-east are beaten, and there is an amalgamation of the *origin./l* and Southern cults. Set is retained, however, and Anubis presides over sepulchres. The priestly headquarters are now at Annu and Abydos. At Annu both the sun and northern stars are worshipped, but at Abydos Osiris, now a sun-god, reigns supreme.

4000 B. C. Another swarm from the north-east, this time certainly from Babylonia and apparently by the isthmus only, since no east and west temples are found on Red Sea routes. They not only worship Anu, but also the spring equinox sun-god.

3700 B. C. The Southern people at Barkal and Thebes in force; temple-building on a large scale. Chnemu begins to give place to Amen-Râ. Still more blending between original and Southern peoples.

3500 B. C. Final blending of North and South cults at Thebes. Temples founded there to Set and Min on the lines of Annu and An.

3200 B. C. The worship of Amen-Râ established at Thebes. Supremacy of the 'Confraternity of Amen.' This marks the final religious unification of the country."

A tentative list of the original members of the rival pantheons is attempted, which we also reproduce.

NORTHERN SCHOOL.

GODS.

Ptah = Capella, and the April sun.
 Anubis = Northern constellations.
 Min } = May sun.
 Khem }

Autumn sun.

Spring sun.

GODDESSES.

Bast-Isis = α Ursa Majoris.
 Taurt-Isis = { α Ursa Majoris.
 γ Draconis.
 Menat-Isis = Spica.
 Serk-Isis = Antares.
 Nit-Isis = Pleiades.

SOUTHERN SCHOOL.

GODS.

Osiris = Moon god.
 Chnemu = Sun god, autumnal equinox.
 Khonsu = Canopus, warning star at the autumnal equinox, on the western horizon; followed by
 Serk-t = α Centauri, on the eastern horizon.

GODDESSES.

Texi-Isis
 Amen-t-Isis } = Phact, afterward Sirius.
 Hathor-Isis }

UNITED SCHOOL.

Amen-Râ = Sun god.

The temples, pyramids, and great Sphinx of Gizeh belong to the Southern or Equinoctial School, and the Colossi of Memnon to the Solstitial School.

The inscriptions state again and again that the gods associated with southern stars came from a locality called the Land of Pun-t, which was always considered a holy land. Brugsch supposed it to have occupied the south and west of Arabia Felix, but Maspero and Mariette identified it with a part of Somáli Land bordering on the Gulf of Aden. The inscriptions, especially those at Dér el Bahair, have made it certain that Pun-t was in Africa. The pictures of Hottentot women, pile-dwellings, and elephants, and references to other products of the country, all point to a southern part of the African continent. This indicates the truthfulness of the ancient tradition recorded by Maspero that the shores of Pun-t were bathed by the waters of an unknown sea (Lake Victoria Nyanza) which could be reached by going up the Nile.

Professor Lockyer strengthens his conclusions by craniological evidence, Virchow testifying that the skulls from the ancient empire are brachycephalic and those from the new dolichocephalic or mesacephalic.

Although Egypt is the principal subject of the book, an interesting series of parallel facts regarding other countries is given. Those referring to Babylonia and Syria are of special importance on account of their bearing on the question of the origin of the Equinoctial School of Egyptian astro-mythology. Also the influence of the Egyptian temple-architecture upon the Greek is traced, and numerous instances of orientation in other countries cited.

Whatever may be thought of the specific conclusions in matters of detail at which Professor Lockyer arrives, it is undeniable that he has opened up a new and exceedingly interesting and important field of research. The history of religions cannot fail to be an immense gainer from this application of exact science to the solution of some of its most fundamental problems.

There is of course danger that the star-theory, like every other explanation of religious origins that has ever been attempted, may be overdone, and structures really built at random, or in relation to terrestrial conditions of some kind, may be too hastily connected with some celestial body or phenomenon. It is conceivable that an apparent orientation might be a mere fortuitous coincidence; though as far as Egypt is concerned there is such a multitude of such instances, and such a converging of all possible lines of evidence towards the same result, as to carry the matter entirely out of the realm of plausible speculation into that of ascertained fact.

But, as Professor Lockyer constantly reiterates, he has merely broken a path into a wonderland whose countless treasures still remain to be gathered by the assiduous investigator. The question of tribal totems and their exact relation to the members of the Pantheon and the heavenly bodies which they represent is an exceedingly interesting one, which calls for much accumulative labor and much care-

ful and painstaking comparison with corresponding features in the religious life of other peoples of every degree of culture all over the globe.

It is scarcely necessary, considering from what press it comes, to add that the typographical get-up of Mr. Lockyer's book is exceedingly good. The paper is excellent, the print is large and clear, and the illustrations well chosen and finely reproduced. In a few instances a plate is laterally reversed, or a pair of reference letters interchanged, but the errors are quite unimportant ones and readily detected.

As the work is one of the most important of the year, and on a subject which is surrounded with obscurities and technicalities, the literary public may well congratulate itself on having it in so attractive and readable a form, and both author and publisher deserve much credit for the result.

Σν.ν.

FROM THE GREEKS TO DARWIN. An Outline of the Development of the Evolution Idea. By *Henry Fairfield Osborn, Sc. D.* New York and London: Macmillan & Co. 1894. Pp. 259. Price, \$2.00.

The present volume forms the opening number of the Columbia University Biological Series edited by Henry Fairfield Osborn, Professor of Biology in Columbia College, and formerly Professor in Princeton. The work is dedicated to Dr. McCosh, and is one of the many good results of the impetus that that lamented teacher gave to the study of philosophy in America. The volume grew out of lectures first delivered in Princeton in 1890 upon the period between Buffon and Darwin, and completed in a fuller course at Columbia in 1893. The chief object of the author is to bring forward the many strong and true features of pre-Darwinian evolution, usually passed over or misunderstood, to place before the reader the evidence of continuity in the development of the evolution idea, and to trace the lines of this development through the history of philosophy. An excellent idea in the plan of the lectures is that of the "environment" of the evolution idea. Professor Osborn sees, and clearly states, that ideas are a product of nature; that they grow and develop like living organisms and that the general features of evolution may be traced in them also. "The final conception of Evolution is to be regarded as a cluster of many subsidiary ideas, which slowly evolved in the environment of advancing human knowledge. Like an animal or plant made up of different parts which have been added one by one along the ages, we can take up this history as we should a bit of biological research; consider the idea as living and still growing, and seek the first stages of each of its parts." The title of the work is a happy one, and seems to have been suggested by Zeller's *The Greek Predecessors of Darwin*. The excellent bibliography appended to the lectures shows that Professor Osborn has employed the best obtainable sources in the philosophy of the subject, and although he lays little claim to originality in the conception and execution of the work, his reputation as a practical biologist leads the reader to expect that his material will be placed under new and instructive points of view.

Throughout the whole history of philosophy and science, the speculations upon